Sensor Design for Distributed Parameter Systems

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Abstract

The development of smart materials makes it feasible to optimize sensor shapes. Optimization over shape is challenging though since the admissible set is infinite-dimensional. Kalman filters are optimal in the sense that they minimize the estimation error variance for given sensors. They are thus popular state estimators for both lumped and distributed parameter systems. Choosing the estimation error variance as the optimization criterion, conditions have been obtained that guarantee well-posedness of the optimal sensor design problem as well as continuity of the cost with respect to sensor design. A framework is constructed using finite-dimensional approximations for calculation of the optimal shape. Sufficient conditions are provided for the finite-dimensional optimal sensor configurations to converge to the infinite-dimensional optimal estimation performance.